band for nearly four years by buying pesos and selling dollars at the official exchange rate—even though Mexican inflation was eroding its value. Eventually the bank ran out of dollars to sell, and the peso collapsed. Kathryn Dominguez of Harvard says that when central banks fight market forces to maintain a fixed exchange rate, they almost always lose. She points out that speculators who sense that a bank is running out of reserves can attack, forcing the bank to buy up more of its national currency and so deplete its remaining funds. They will then score a large profit after the ensuing devaluation.

Central banks whose governments are not wedded to a fixed exchange rate, in contrast, can both make money and have a significant influence on exchange rates. The U.S. has profited to the tune of several billion dollars from Federal Reserve trading during the past decade, according to Dominguez.

The key to such politically and financially profitable transactions, she says, is not so much in the detailed pattern of trades—the billion dollars or so that the Fed may put in play is no larger than what a large multinational corporation might stake—as in the information that government actions convey to other market participants. When the Fed moves to shore up the dollar, it may accompany its purchases with public predictions that U.S. interest rates might soon rise, thus making dollars a more attractive investment. Many observers have traced recent failures to halt the dollar's decline to a belief that the Fed will not raise rates because of the potential damage to the U.S. economy.

So what is next, and how much does it matter? Dominguez and her colleagues are fairly sanguine about effects on the U.S.: the falling dollar aids exporters, and imports from Japan and Germany are a small enough part of the economy that price increases for foreign goods will probably not cause significant inflation. In Mexico the peso crash helped to push up some consumer prices by 25 percent or more.

Paradoxically, the countries with stronger currencies may be hurt more as their exports dry up. Eventually exchange rates should settle to a new equilibrium, but, as Velasco points out, there is always another shock waiting to push them out of line.—*Paul Wallich*

TECHNOLOGY AND BUSINESS

Suck It to Me

Pneumatic tubes make a comeback

New York University professor Ken Phillips gives his class a trick question on examinations for a course on the history of technology. Students have to pick the fastest form for transmitting digital data: among the choices are a high-speed fiber-optic connection, a microwave radio link or a pneumatic tube. Invariably, Phillips's students think the pneumatic tube to be a ludicrous answer.

GEOFFREY WHEELER *Black Star*

***AIRBORNE EXPRESS** by pneumatic tube delivers tools and repair parts at the Denver International Airport.*

They are wrong. What they forget is that some technologies still prove more efficient when electrons remain firmly attached to the odd bundle of protons and neutrons. A pneumatic tube can, in seconds, send over short distances anything from a vial of blood or a corned beef sandwich to a few 40-billion-byte data storage tapes. The 17th-century throwback is a kind of information superhighway of the corporeal. True, most department store clerks, equipped with the electronic cash register, no longer send money to a bookkeeper by tube. Nor does mail travel across Paris—or the Brooklyn Bridge, for that matter—by air pipe.

But in a small triumph for a reality that has yet to go virtual, the tube is back. Manufacturers have seen sales of their products rise in recent years. At about $100 million, U.S. sales have doubled during the past decade, according to TransLogic, a Denver-based company that is the largest domestic producer. (Market researchers ignore pneumatic tubes; they prefer to keep books on multimedia personal computers.)

Tubes have also helped automate one of the fastest-growing U.S. industries. They increasingly serve as the means by which blood or urine samples, spinal fluids and other specimens get from an emergency room or intensive care unit to laboratories. This form of conveyance is quicker and less costly than having a human porter do the same job. Kaiser-Permanente Medical Center in Los Angeles has a $3-million system of 15 miles of tubing that it uses to transport medical records throughout its 11-building complex.

Besides selling to hospitals, tube companies have installed their systems at airports for shuttling aircraft parts to hangar repair stations and in steel mills to move molten samples to a testing department.

This renaissance has occurred because of a marriage of the ancient with the new. Canisters, called carriers, that rocket through air-blown pipes can now be tracked along each leg of a journey with optical sensors that relay to a computer the whereabouts of a parcel. This precision tracking means the location of a carrier that gets stuck can be pinpointed within a network, making delivery more reliable.

Modern tube systems dispense with the 19th-century hand-operated bellows that created suction to move a carrier along. Yet the physical principles remain the same. Propulsion results from a combination of blowing and sucking. A motorized fan either directs a draught behind a carrier, or it removes air, creating a vacuum that sucks the container through the ducts. Air volume and pressure can be varied to control the carrier's speed, allowing it to be eased to a soft landing. Blood products might otherwise hemolyze, or rupture, because of exposure to high gravity forces through turns or on ejection from the tube. Tube networks are also equipped with railroad-track-like switches that route a carrier among different segments of the network.

The basic concept predates the industrial revolution by about a century. In the 1660s the Royal Society of London received a paper for a "double pneumatic pump," and a prototype was eventually constructed. One of the first

working tube systems arrived in the 1850s. It was then that the Electric and International Telegraph Company built a 220-yard tube to relay paper telegrams to the London stock exchange—a Victorian version of electronic mail.

In the U.S., tubes became the means of delivering cash from a clerk to a store bookkeeper in five-and-dime stores. The bookkeeper would receive the money and send back the change. Tubes replaced "cash children," 10-, 11- and 12-year-olds who were exploited to perform this task.

The most elaborate plan for these air-driven guided missiles originated with a former editor and publisher of this magazine, Alfred Ely Beach. He secretly built New York City's first subway in 1870, a pneumatically propelled train that ran in a block-long, nine-foot-diameter tunnel below Broadway, near City Hall. But Beach made a fatal error by failing to enlist the support of then reigning Tammany Hall captain William "Boss" Tweed. When belatedly told of the tunnel train under Broadway, Tweed quashed Beach's ambitious intent to expand his subway citywide.

A variation on Beach's idea reemerged in the mid-1960s, when L. K. Edwards, an engineer for Lockheed Missiles and Space Company, took an extended leave of absence to become president of Tube Transit, Inc. Writing for *Scientific American* in August of 1965, Edwards proposed building two evacuated pipes from Washington to Boston that would let "tube trains" travel between the cities at 500 miles per hour, making the trip into a 90-minute journey.

Even today there is something about these burrowlike wall cavities that appeals to the rodent in everyone. A pneumatic tube became an important prop in last year's film revival of the radio classic *The Shadow*.

And a Japanese company has actually used a pneumatic tube to build a prototype of a better mousetrap. Ikari Corporation lines inner building walls with tubes that contain holes for the vermin to climb into. When a sensor detects the body heat of a furry little creature, a shutter closes over the holes and a plastic ball, blown through the tube by air jet, carries the mouse or rat through the tube and deposits it in a freezer.

What goes around comes around. But N.Y.U. professor Phillips may soon no longer be able to pop his trick question. Telephone companies are beginning to put in place fiber-optic networks that can carry the equivalent of many encyclopedias' worth of textual data in a mere second. Phillips does not fret, however: "Light waves still can't deliver a corned beef sandwich." —*Gary Stix*